

**TUNABLE, MULTI-PORT OPTICAL ADD-DROP MULTIPLEXER****ABSTRACT OF THE DISCLOSURE**

A tunable (reconfigurable) OADM provides multiple drop ports and multiple add  
5 ports by which desired channels can be removed from, or added to, a composite  
optical signal. The channels added to and dropped from the optical signal can be  
individual channels (with a single wavelength per channel) and therefore enabled for  
direct connection to fixed (or tunable) optical transmitters and optical receivers,  
respectively. Alternatively, the channels added to and dropped from the optical signal  
10 can themselves be multiplexed, enabling more advanced features. The OADM  
provides a low loss architecture for all the optical signals that traverse through the  
device, as required for transparent optical networks. In one embodiment, a  
programmable demultiplexer is arranged to receive an input signal containing  
components at  $x$  different wavelengths from an optical input port, and distribute the  
15 input signal components among  $K$  output ports.  $K-1$  of the output ports are the  
“drop” ports of the OADM, and cumulatively contain  $w$  different wavelengths. The  
remaining port, which is the “through port” that carries the  $z$  wavelengths not dropped  
from the original input signal, is connected to the first port of an  $M$  port programmable  
multiplexer having  $M-1$  other input ports. The remaining  $M-1$  ports are the “add”  
20 ports of the OADM, which cumulatively receive  $v$  different wavelengths to be added  
by the OADM. By appropriately controlling the demultiplexer and multiplexer, the  
OADM can independently both drop and add channels to the optical signal, resulting  
in an output signal containing  $y$  wavelengths. In the foregoing description,  $v$ ,  $w$ ,  $x$ ,  $y$   
and  $z$  are integers, where  $x+v-w = y$  and  $z = x-w = y-v$ .